What is claimed is:

1. An isolated hyperactive reverse transcriptase comprising one or more point mutations in the processivity domain and one or more point mutations in the nucleotide selection domain.

2. The reverse transcriptase of claim 1, wherein the reverse transcriptase is selected from the group consisting of AMV, M-MLV, HTLV-1, BLV, RSV, HFV, R2 *Bombyx mori*, and HIV reverse transcriptase.

3. The reverse transcriptase of claim 1, wherein the reverse transcriptase is encoded by a modified nucleotide sequence that encodes a modified amino acid sequence modified in the processivity domain corresponding to amino acids 497 to 671 of M-MLV reverse transcriptase.

4. The reverse transcriptase of claim 1, wherein the reverse transcriptase is encoded by a modified sequence that encodes a modified amino acid sequence modified in the nucleotide selection domain corresponding to amino acids 153 to 158 of M-MLV reverse transcriptase.

5. The reverse transcriptase of claim 1, wherein the reverse transcriptase may be used in the preparation of full-length cDNA.

6. The reverse transcriptase of claim 1, wherein the reverse transcriptase comprises reverse transcriptase produced recombinantly.

7. The reverse transcriptase of claim 1, wherein the reverse transcriptase is purified.

8. The reverse transcriptase of claim 1, wherein the reverse transcriptase is purified and is greater than 90% pure.

9. The reverse transcriptase of claim 1, wherein the mutation in the processivity domain comprises one or more of mutations in the following residues in MMLV-RT: H638, Y586, D653, D524, D524 and E562.

10. The reverse transcriptase of claim 1, wherein the mutation in the processivity domain comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D.

11. The reverse transcriptase of claim 1, wherein the mutation in the nucleotide selection domain comprises one or more mutations in the following residues in MMLV-RT: F155, D153, A154, F155, F156, C157, or L158.

12. The reverse transcriptase of claim 1, wherein the mutation in the processivity domain comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D and the mutation in the nucleotide selection domain comprises F155Y.

13. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 1 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

14. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 5 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

15. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 7 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

16. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 10 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

17. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 15 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

18. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 25 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

19. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 1 ug of an aRNA from 10 pg of template RNA after a two-round amplification reaction.

20. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 2 ug of an aRNA from 10 pg of template RNA after a two-round amplification reaction.

21. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 5 ug of an aRNA from 10 pg of template RNA after a two-round amplification reaction.

22. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a yield of greater than about 10 ug of an aRNA from 10 pg of template RNA after a two-round amplification reaction.

23. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a cDNA greater than about 6, 9 or even 11 kilobases in a single cDNA synthesis reaction.

24. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a cDNA greater than about 6 to about 15 kilobases in a single cDNA synthesis reaction.

25. The reverse transcriptase of claim 1, wherein the reverse transcriptase produces a cDNA greater than about 15 kilobases in a single cDNA synthesis reaction.

26. The reverse transcriptase of claim 1, wherein the DNA polymerase activity is greater than about 200 Units per microgram.

27. The reverse transcriptase of claim 1, wherein the DNA polymerase activity is between about 0.1 and 300 Units per microgram.

28. The reverse transcriptase of claim 1, wherein the RNase H activity is between about 0.1 and about 25 percent of the wild-type RNase H activity.

29. An isolated reverse transcriptase having substantially reduced RNase H activity comprising one or more point mutations in the processivity domain.

30. The reverse transcriptase of claim 29, wherein the RNase H activity is between about 0.1 and 50 % of wild-type activity.

31. The reverse transcriptase of claim 29, wherein the RNase H activity is between about 1 and 10 % of wild-type activity.

32. The reverse transcriptase of claim 29, wherein the mutation in the processivity domain comprises one or more of mutations in the following residues in MMLV-RT: H638, Y586, D653, D524, D524 and E562.

33. The reverse transcriptase of claim 29, wherein the mutation in the processivity domain comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D.

34. The reverse transcriptase of claim 29, further comprising a mutation in the nucleotide selection domain comprises a mutation of residue F155 in MMLV-RT.

35. The reverse transcriptase of claim 29, wherein the mutation in the processivity domain comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D and further comprising a mutation in the nucleotide selection domain such as F155Y.

36. An isolated protein comprising DNA polymerase activity and substantially reduced RNase H activity comprising one or more mutations in the processivity domain and the nucleotide selection domain.

37. The protein of claim 36, wherein the protein produces a yield of greater than about 1, 5, 7, 10, 12, 15, 25 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

38. The protein of claim 36, wherein the protein produces an aRNA yield of greater than about 20% as compared to an equivalent wild-type Reverse Transcriptase enzyme.

39. The protein of claim 36, wherein the protein produces a yield of greater than about 5 or 10 ug of an aRNA from 10 pg of template RNA after a two-round amplification reaction.

40. The protein of claim 36, wherein the protein produces a cDNA greater than about 6, 9 or even 11 kilobases in a single cDNA synthesis reaction.

41. The protein of claim 36, wherein the protein produces a cDNA greater than about 6 to about 15 kilobases in a single cDNA synthesis reaction.

42. The protein of claim 36, wherein the protein produces a cDNA greater than about 15 kilobases in a single cDNA synthesis reaction.

43. The protein of claim 36, wherein the DNA polymerase activity is greater than about 200 Units per microgram.

44. The protein of claim 36, wherein the DNA polymerase activity is between about 0.1 and 300 Units per microgram.

45. The protein of claim 36, wherein the RNase H activity is between about 0.1 and about 25 percent of the wild-type RNase H activity.

46. An isolated and purified reverse transcriptase protein comprising one or more mutations in the nucleotide selection domain.

47. The reverse transcriptase of claim 46, wherein the reverse transcriptase is selected from the group consisting of AMV, M-MLV, HTLV-1, BLV, RSV, HFV, R2 *Bombyx mori*, and HIV reverse transcriptase.

48. The reverse transcriptase of claim 46, wherein the reverse transcriptase further comprises a modified nucleotide sequence that encodes a modified amino acid sequence in the processivity domain corresponding to amino acids 497 to 671 of M-MLV reverse transcriptase.

49. The reverse transcriptase of claim 46, further comprising one point mutation in the nucleotide selection domain corresponding to amino acids 153 to 158 of MMLV reverse transcriptase.

50. The reverse transcriptase of claim 46, wherein the reverse transcriptase may be used in the preparation of full-length cDNA.

51. The reverse transcriptase of claim 46, wherein the mutation in the processivity domain comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D.

52. The reverse transcriptase of claim 46, wherein the reverse transcriptase produces a yield of greater than about 1, 5, 7, 10, 12, 15, 25, 40 or 50 ug of an aRNA from 100 ng of template RNA in a single amplification reaction.

53. The reverse transcriptase of claim 46, wherein the reverse transcriptase produces a yield of greater than about 1, 5 or 10 ug of an aRNA from 10 pg of template RNA after a double amplification reaction.

54. The reverse transcriptase of claim 46, wherein the reverse transcriptase produces a cDNA greater than about 6, 9 or even 11 kilobases in a single cDNA synthesis reaction.

55. The reverse transcriptase of claim 46, wherein the reverse transcriptase produces a cDNA greater than about 15 kilobases in a single cDNA synthesis reaction.

56. The reverse transcriptase of claim 46, wherein the DNA polymerase activity is greater than about 200 Units per microgram.

57. The reverse transcriptase of claim 46, wherein the DNA polymerase activity is between about 0.1 and 300 Units per microgram.

58. The reverse transcriptase of claim 46, wherein the RNase H activity is between about 0.1 and about 25 percent of the wild-type RNase H activity.

59. A reverse transcriptase protein comprising one or more mutations in the nucleotide selection domain and in the processivity domain.

60. An isolated and purified protein comprising one or more mutations in the processivity domain and one or more mutations in the nucleotide selection domain.

61. A process for making a protein with hyperactive reverse transcriptase activity comprising the steps of:

transforming a host cell with the hyperactive reverse transcriptase comprising a mutation in the processivity domain that comprises one or more of the following mutations corresponding to the amino acids in MMLV-RT: H638G, Y586A, D653N, D524N, D524E and E562D and further comprising a F155Y mutation in the nucleotide selection domain of MMLV-RT; and

culturing the host cell under conditions such that the hyperactive reverse transcriptase is produced by the host cell.

62. An isolated and purified nucleic acid comprising a hyperactive reverse transcriptase with a mutation in the processivity domain and in the nucleotide selection domain.

63. The nucleic acid of claim 62, wherein the hyperactive reverse transcriptase comprises a mutation that corresponds to and includes an H638G mutation of the MMLV-RT.

64. The nucleic acid of claim 62, wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase further comprising an F155Y mutation.

65. The nucleic acid of claim 62, wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase further comprising an F155Y mutation and an H638G mutation.

66. The nucleic acid of claim 62, wherein the nucleic acid of SEQ ID No.: 1 further comprises a nucleic acid segment encoding a leader sequence.

67. The nucleic acid of claim 62, wherein the nucleic acid of SEQ ID NO.: 1 further comprises a nucleic acid segment encoding a protein segment other than the hyperactive reverse transcriptase.

68. An isolated and purified nucleic acid that encodes a hyperactive reverse transcriptase comprising one or more mutations in the processivity domain.

69. The reverse transcriptase of claim 68, wherein the mutation in the processivity domain comprises one or more of mutations in the following residues in MMLV-RT: H638, Y586, D653, D524, D524 and E562.

70. The nucleic acid of claim 68, wherein the hyperactive reverse transcriptase comprises an H638G mutation.

71. The nucleic acid of claim 68, wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase further comprising an F155Y mutation and an H638G mutation.

72. The nucleic acid of claim 68, wherein the nucleic acid of SEQ ID NO.: 1 further comprises a nucleic acid segment encoding a leader sequence.

73. The nucleic acid of claim 68, wherein the nucleic acid of SEQ ID NO.: 1 further comprises a nucleic acid segment encoding a protein segment other than the hyperactive reverse transcriptase.

74. A vector comprising a nucleic acid that comprises a nucleic acid encoding a hyperactive reverse transcriptase comprising a mutation in the processivity domain and in the nucleotide selection domain.

75. A vector comprising a nucleic acid that comprises a nucleic acid encoding a hyperactive reverse transcriptase comprising a mutation in the nucleotide selection domain.

76. A vector comprising a nucleic acid that comprises a nucleic acid encoding a hyperactive reverse transcriptase comprising a mutation in the processivity domain.

77. A host cell transformed with an expression vector comprising a nucleic acid encoding an amino acid of SEQ ID NO.: 2 that encodes a hyperactive reverse transcriptase.

78. The host cell of claim 77, wherein the host cell comprises E. coli.

79. A host cell transformed to express a hyperactive reverse transcriptase.

80. A process for making an isolated hyperactive reverse transcriptase comprising the steps of:

transforming a host cell with an isolated nucleic acid that encodes a hyperactive reverse transcriptase; and

culturing the host cell under conditions such that the hyperactive reverse transcriptase is produced.

81. The process of claim 80, wherein the hyperactive reverse transcriptase comprises an H638G mutation.

82. The process of claim 80, wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase further comprising an F155Y mutation.

83. The process of claim 80, wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase further comprising an F155Y;H638G mutation.

84. A hyperactive reverse transcriptase in which one or more mutations replace at least one of the amino acids of the processivity domain and the nucleotide selection domain, with an alternative naturally occurring L-amino acid, the replacement being selected from the group

consisting of: (1) a substitution of any of isoleucine, valine, and leucine for any other of these amino acids; (2) a substitution of aspartic acid for glutamic acid or vice versa; (3) a substitution of glutamine for asparagine or vice versa; (4) a substitution of serine for threonine or vice versa; (5) a substitution of glycine for alanine or vice versa; (6) a substitution of alanine for valine or vice versa; (7) a substitution of methionine for any of leucine, isoleucine, or valine and vice versa; and (8) a substitution of lysine for arginine or vice versa.

85. The reverse transcriptase of claim 84, wherein the replacement is selected from the group consisting of: (1) a substitution of any of isoleucine, valine, or leucine for any other of these amino acids; (2) a substitution of aspartic acid for glutamic acid or vice versa; (3) a substitution of glutamine for asparagine or vice versa; and (4) a substitution of serine for threonine or vice versa and wherein the hyperactive reverse transcriptase comprises a hyperactive reverse transcriptase.

86. A kit for nucleic acid synthesis, comprising, in a suitable container:

a hyperactive reverse transcriptase; and

a reaction solution for the reverse transcriptase.

87. The kit of claim 86, further comprising an insert that comprises information for using the reverse transcriptase.

88. The kit of claim 86, wherein the reaction solution comprises a reverse transcriptase reaction buffer.

89. The kit of claim 86, further comprising a primer.

90. The kit of claim 86, wherein the reaction solution comprises a reverse transcriptase buffer.

91. The kit of claim 86, wherein the reaction solution comprises a PCR buffer.

92. The kit of claim 86, further comprising a mix of nucleotides.

93. The kit of claim 86, further comprising containers comprising individual nucleotides.

94. The kit of claim 86, wherein the reaction solution comprises a buffer for in vitro transcription.

95. The kit of claim 86, further comprising a template purification column.

96. The kit of claim 86, further comprising magnetic particles suitable for nucleic acid purification.

97. A kit for nucleic acid synthesis, comprising, in a suitable container:

a hyperactive reverse transcriptase comprising one point mutation in the processivity domain; and

a reaction solution for the reverse transcriptase.

98. A kit for nucleic acid synthesis, comprising, in a suitable container:

a hyperactive reverse transcriptase comprising one point mutation in the processivity domain and one point mutation in the nucleotide selection domain; and

a reaction solution for the reverse transcriptase.

99. A method for RNA amplification comprising the steps of:

reverse transcribing an RNA template into a single-stranded cDNA with a hyperactive reverse transcriptase in the presence of an oligonucleotide comprising a transcriptional promoter and a primer;

purifying the single-stranded cDNA; and

generating amplified RNA (aRNA) using an RNA polymerase.

100. A method for RNA amplification comprising the steps of:

reverse transcribing an RNA template into a single-stranded cDNA with a hyperactive reverse transcriptase in the presence of an oligonucleotide comprising a transcriptional promoter and a primer;

converting the single-stranded cDNA into double-stranded cDNA using a DNA polymerase;

purifying the double-stranded cDNA; and

7 generating amplified RNA (aRNA) using an RNA polymerase.

1 101. The method of claim 100, further comprising the step of purifying the aRNA.

1 102. A kit for RNA amplification, comprising, in a suitable container:

2 a hyperactive reverse transcriptase comprising one or more point mutations in the processivity
3 domain and one or more point mutations in the nucleotide selection domain; an oligonucleotide
4 comprising a transcriptional promoter region and oligo(dT) region; a DNA polymerase; and an
5 RNA polymerase.

1 103. The kit of claim 102, further comprising an insert that comprises information for using
2 the optimized reverse transcriptase.

1 104. The kit of claim 102, wherein the reaction solution comprises a 10X concentrated reverse
2 transcriptase reaction buffer.

1 105. The kit of claim 102, further comprising a primer.

1 106. The kit of claim 102, wherein the reaction solution comprises a reverse transcriptase
2 buffer.

1 107. The kit of claim 102, wherein the reaction solution comprises a DNA Polymerase buffer.

1 108. The kit of claim 102, further comprising a mix of nucleotides.

1 109. The kit of claim 102, further comprising containers comprising individual nucleotides.

1 110. The kit of claim 102, wherein the reaction solution comprises a buffer for in vitro
2 transcription.

1 111. The kit of claim 102, further comprising a nucleic acid purification column.

1 112. The kit of claim 102, further comprising a magnetic particle or particles suitable for
2 nucleic acid purification.

1 113. An aRNA made by the method of claim 995.

1 114. An aRNA made by the method of claim 100.

115. A kit for RNA amplification, comprising, in a suitable container:

a hyperactive reverse transcriptase comprising one or more point mutations in the processivity domain; an oligonucleotide comprising a transcriptional promoter region and oligo(dT) region; a DNA polymerase; and an RNA polymerase.

116. The kit of claim 115, further comprising an insert that comprises information for using the optimized reverse transcriptase.

117. The kit of claim 115, wherein the reaction solution comprises a 10X concentrated reverse transcriptase reaction buffer.

118. The kit of claim 115, further comprising a primer.

119. The kit of claim 115, wherein the reaction solution comprises a reverse transcriptase buffer.

120. The kit of claim 115, wherein the reaction solution comprises a DNA polymerase buffer.

121. The kit of claim 115, further comprising a mix of nucleotides.

122. The kit of claim 115, further comprising containers comprising individual nucleotides.

123. The kit of claim 115, wherein the reaction solution comprises a buffer for in vitro transcription.

123. The kit of claim 115, further comprising a nucleic acid purification column.

125. The kit of claim 115, further comprising one or more magnetic particles suitable for nucleic acid purification.

126. An aRNA comprising:

a ssDNA or a DNA:RNA hybrid made from an RNA template by a hyperactive reverse transcriptase.

127. An RT-PCR kit comprising in one or more suitable containers: a hyperactive reverse transcriptase, two or more primers, nucleotides, a thermostable DNA polymerase and an RT-PCT buffer.

128. The RT-PCR kit of claim 127, wherein the container comprising a hyperactive reverse transcriptase further comprises one or more reverse transcriptases.